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EPIDEMIOLOGIC RESEARCH ON  
OCCUPATIONAL ILLNESS AND  
INJURY IN THE NATIONAL  
OCEAN SERVICE WAGE  
MARINE WORK FORCE

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A. HOIBERG

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NAVAL HEALTH RESEARCH CENTER  
P.O. BOX 85122  
SAN DIEGO, CALIFORNIA 92138

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EPIDEMIOLOGIC RESEARCH ON OCCUPATIONAL ILLNESS AND INJURY  
IN THE NATIONAL OCEAN SERVICE WAGE MARINE WORK FORCE

Anne Hoiberg  
Naval Health Research Center  
P.O. Box 85122  
San Diego, California 92138-9174

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## SUMMARY

### Problem

In the mid-1980s, the Public Health Service developed the Occupational Illness and Injury Contingency Management Process (OPTICOMAP) to ensure the coordination of care and management of each case of occupational illness or injury. Before implementing OPTICOMAP, information from a previous year is needed to provide baseline data for evaluating the effectiveness of OPTICOMAP in helping occupationally injured or ill workers return to work and in reducing the high costs for medical care, compensation, and disability.

### Objectives

The purpose of this study was (1) to identify occupational illnesses and injuries that occurred in 1986 in the Atlantic and Pacific basins, National Ocean Service, Office of Marine Operations, and (2) to present an overview of illness or injury incidence by contributing factors in each basin. (Aw/mjw)

### Approach

Using the claims records of the 32 and 68 cases of work-related illnesses or injuries that occurred during 1986 in the Atlantic and Pacific basins, respectively, frequency and percentage distributions were compiled and comparisons were conducted between basins on selected variables. A  $z$ -test of the significance of differences between proportions was conducted to determine extent of statistical significance. Incidence rates per 1,000 men for each diagnostic category were computed and compared across 19 vessels.

### Results and Discussion

The most frequently occurring occupational injuries in this wage marine work force included those affecting the back, ankle, knee, hand, wrist, and finger. Falling was the most frequent reason causing an occupational injury, followed by pushing or pulling objects, receiving a cut or burn, and lifting. Hearing loss was the only occupationally sustained illness that resulted in a claim for compensation in 1986. In comparisons across age levels, occupations, and ships, the majority of injuries occurred among wage marines less than 40 years of age; however, almost all hearing loss and back injuries were noted among workers older than 30 years of age. Engine department personnel in the Atlantic basin had the highest total percentages of hearing loss and

injuries whereas deck personnel on Pacific basin vessels had the second highest proportions, especially for ankle and knee injuries. Considerable variability in incidence rates was observed across ships, with the highest rates noted for the Pacific basin vessels of the Fairweather, David Starr Jordan, and Miller Freeman. Almost 50% of injured workers did not lose any time from work, and the majority lost from 0 to 7 days. Three individuals with back injuries continued to be off duty. "Continuation of pay" was received by 37.5% and 50.0% of injured employees in the Atlantic and Pacific basins, respectively. Differences in costs between basins were noted in that back injuries among Pacific basin personnel accounted for higher medical, continuation of pay, and compensation costs as contrasted with elevated costs for hearing loss compensation in the Altantic basin. Results revealed no significant differences between basins on the variables of motivation to return to work, restoration to full potential, state of mental well-being, effectiveness of surgical procedure, and effectiveness of treatment.

#### Recommendations

Such findings point toward several recommendations that could be implemented. First, safety programs for the prevention of injuries to the back could prove beneficial by potentially reducing the high incidence rate and costs incurred for these conditions. Job requirements and physical standards should be established for each job, especially by age. Second, treatment of decks to make them less slippery should be reviewed, especially on Pacific basin ships where rough seas, rain, and ice patches are common climatic conditions. Third, protective gear for the eyes and ears should be worn while performing many jobs and working in hazardous situations. Fourth, a program on dental hygiene might help to reduce the incidents of chipped and broken teeth observed in Pacific basin workers. Fifth, an alcohol (and drug) abuse prevention program should be incorporated into the safety training and health promotion series, and assignment to an alcohol rehabilitation program should be recommended for employees who suffered an alcohol-related injury. Also recommended is instituting the role of the care coordinator-claims facilitator to monitor the well-being and return-to-work plans of injured workers.

**Epidemiologic Research on Occupational Illness and Injury  
in the National Ocean Service Wage Marine Work Force**

Anne Hoiberg

Rising costs for medical care, compensation, and disability have placed increased emphasis on creating a process to ensure the coordination of care and management of claims in cases of occupational illness or injury. In the mid-1980s, the United States Public Health Service (PHS), Division of Federal Occupational and Beneficiary Health Service, Research and Development Activity, initiated the development of the Occupational Illness and Injury Contingency Management Process (OPTICOMAP), which was designed to encompass the two requirements of care coordination and claims facilitation. To be specific, the objectives of OPTICOMAP are (1) to help solve the complex problems faced by occupationally injured or ill employees; (2) to manage and administer each case of occupational illness and injury; and (3) to contain the costs incurred for medical care, continuation of pay, compensation, and death benefits.

The basis of OPTICOMAP extends beyond mere claims management and concentrates on the issues associated with the care not only of, but for, the occupationally injured or ill employee. The process is designed to increase the extent of personal interaction which not only will decrease incidents of "delayed recovery syndrome" in the short term but also costs for care and disability in the long term. Delayed recovery syndrome is suspected in cases where the recovery of a physical injury goes beyond normal medical expectations for an apparently nonphysical reason.

The implementation of OPTICOMAP occurred 1 October 1987 in the Pacific basin operations of the National Ocean Service (NOS), Office of Marine Operations (OMO). The data collection phase of this demonstration program will cover a one-year time period through 30 September 1988, with a two-part evaluation to be initiated at the mid-point and conclusion. Another important aspect of an effective work place program, which includes a process such as OPTICOMAP, is to conduct concurrent or retrospective reviews of compensation claims as well as analyses of disability record and other

associated data sources (Berkowitz, 1985; Polakoff, 1986). Therefore, to provide background and baseline information for the 1987-1988 data, all of the occupational illness and injury data collected during 1986 in the Atlantic and Pacific basins were summarized.

The purpose of this study was to identify all occupational illnesses and injuries during 1986 and to present an overview of the illnesses and injuries by contributing factors in the Atlantic and Pacific basins. In subsequent studies, results of this retrospective project will be compared with those from the 1987-1988 prospective project to evaluate the overall effectiveness of OPTICOMAP not only in reducing the high costs of occupational mishaps but also to more efficiently manage cases to ensure rapid healing and a quick return to work.

#### METHOD

##### **Participants and Data Sources**

Participants in this study included wage marines of the NOS, OMO, who had suffered an occupationally sustained illness or traumatic injury during 1986 in Atlantic basin operations ( $n = 32$  in a fleet population of 205) or Pacific basin operations ( $n = 68$  among 351 wage marines). These 100 incidents occurred in a variety of locations: onboard one of nine vessels homeported in the Atlantic basin or one of 10 vessels in the Pacific basin, on liberty in a port of call, or at a shore facility while the ship was in port.

Data used in this study were obtained from both the Eastern and Western Administrative Support Centers of the National Oceanic and Atmospheric Administration (NOAA). Specific information included demographic variables on each individual as well as operational data pertinent to each NOAA ship. A photocopy of the entire record of each occupational illness and injury that occurred in 1986 was forwarded to the Naval Health Research Center, San Diego, CA. Information extracted from these records consisted of age and occupation at the time of illness or injury; ship or duty assignment; date, diagnoses, and circumstances of each illness or injury; costs for medical care, continuation of pay, compensation, and death benefits; time lost from work and the return-to-work date; effectiveness of surgery and treatment; and frequency and content of correspondence, medical reports, and telephone

communications. Information obtained from these latter sources were used to assess the extent of the injured employee's motivation to return to work, restoration to his or her full physical potential, and state of his or her mental well-being.

#### **Procedure**

Frequency and percentage distributions of seven broad illness or injury categories were compiled for both the Atlantic and Pacific basins by cause of illness or injury, age at the time of incident, occupation, time lost from work, medical costs, continuation of pay, compensation (including 41 older cases that were active during 1986), and five criteria of overall care outcome. A  $z$ -test of the significance of differences between proportions was performed on these variables to determine the level of statistical significance between the two basins. The diagnostic categories consisted of injuries to the (1) ankle, knee, and leg (fracture, sprain, laceration, etc.); (2) back (herniated disc, strain); (3) hand, arm, and finger (sprain, laceration, burn, near amputation); (4) trunk, head, shoulder, rib, and lung (sprain, strain, fracture, inhalation, etc.); (5) teeth, lip, and facial bones (loss, laceration, etc.); and (6) eye and eyelid (burn, laceration, etc.) as well as (7) the occupationally sustained illness of hearing loss. Incidence rates per 1,000 strength for these seven diagnostic categories also were computed for each of 19 NOAA vessels reporting an illness or injury in 1986.

#### **RESULTS**

##### **Causes of Occupational Illness or Injury**

Table 1 is a presentation of the frequency and percentage distributions for each cause by the bodily site of the illness or injury. As shown, injuries caused from falling accounted for the highest percentage of incidents among Pacific basin personnel whereas cuts and burns occurred with greatest frequency in the Atlantic basin. For both basins, the most frequently reported sites of an occupational injury were the ankle, knee, and leg. These injuries were caused primarily from falling; wet or oily decks, missed steps on a ladder or stairwell, and patches of ice (only in the Pacific basin) were implicated as the major reasons for falling. Back injuries, the second most frequently occurring injury, were caused from

TABLE 1  
Percentage Distribution of Reasons for Occupational Injury/  
Illness in the National Ocean Service Wage Marine Work Force, 1986

Injury/Illness	AMC	PMC	Reason for Injury/Illness (%)														
			Pushing/ Pulling		Cuts/ Burns		Lifting		Foreign Object		Noise/ Eating		On Liberty Alcohol/ Falling				
	AMC	PMC	AMC	PMC	AMC	PMC	AMC	PMC	AMC	PMC	AMC	PMC	AMC	PMC			
Ankle, knee	11	24	18.8	20.6	3.1	5.9	3.1	0	0	6.3	4.4	0	0	2.9	3.1	1.5	
Back	4	15	3.1	7.4	3.1	1.5	0	0	6.3	11.8	0	0	0	0	0	1.5	
Hand, arm	7	10	0	2.9	3.1	2.9	18.8	7.4	0	0	0	0	0	0	0	1.5	
Trunk, head	5	5	0	1.5	9.4	4.4	0	0	0	1.5	3.1	0	0	3.1	0	0	
Teeth, face	0	8	-	2.9	-	0	-	0	-	0	-	7.4	-	1.5	-	0	
Eye, eyelid	1	5	0	0	1.5	3.1	1.5	0	0	4.4	0	0	0	0	0	0	
Hearing loss	4	1	0	0	0	0	0	0	0	0	12.5	1.5	0	0	0	0	
Total	32	68	21.9	35.3	18.7	16.2	25.0	8.8*	6.3	13.3	9.4	8.8	12.5	8.8*	3.1	4.4	3.1 4.4*

Note: The two fleet operation centers of the National Ocean Service, Office of Marine Operations, are abbreviated to AMC for Atlantic basin operations and PMC for Pacific basin operations.

\*Because of rounding, the summed totals differ by 0.1.

lifting (more notably among Pacific than Atlantic basin personnel), falling, pulling, and pushing. Cuts and burns represented the leading reasons for injuries reported to the hand, arm, and finger. Almost all of the broken teeth resulted from biting on bones or other hard foodstuffs while all of the hearing loss cases were attributed to excessive noise levels. Alcohol abuse contributed to at least four of the reported injuries. Results of z-test computations revealed no significant differences between basins.

#### **Age at Time of Occupational Illness or Injury**

Table 2 shows the frequency and percentage distributions of occupational illnesses and injuries by age at the time of onset. The majority of injuries occurred among wage marines less than 40 years of age. Almost all of the cases of hearing loss and back injury, on the other hand, were noted among workers older than 30 years of age. The Pacific basin had a larger, although nonsignificant, proportion of injuries in the 30- to 39-year interval; the largest percentage difference between basins was observed at this age level for injuries to the trunk, head, ribs, and lungs ( $z = 1.87$ ;  $p = 0.06$ ).

#### **Occupation and Ship as Factors in Occupational Illness or Injury**

Because of the relatively few cases reported for each of 32 specific occupations, the frequency and percentage distributions were compiled according to ship department. As presented in Table 3, the highest percentages were noted among deck personnel in both basins and for engine department personnel on Atlantic basin vessels; no significant differences between basins were observed. Ankle and knee injuries occurred with greatest frequency among deck personnel while hearing loss was observed primarily among engine department personnel.

Tables 4 and 5 present the incidence rates per 1,000 strength of occupational illness and injury by ship in the Pacific and Atlantic basins. These tables reveal considerable variability in incidence rates across ships: from 66.7 to 383.0 per 1,000 in the Pacific basin (Table 4) and from 34.5 to 209.3 among Atlantic basin vessels (Table 5). Ships with the highest incidence rates included the Fairweather, David Starr Jordan, and Miller Freeman, all of which served in the Pacific basin during 1986. Specific results revealed that the highest rate of back injuries was noted on the

TABLE 2

## Percentage Distribution of Age at Onset of Occupational Injury/Illness in the National Ocean Service Wage Marine Work Force, 1986

Injury/Illness	No. of Cases	Age at Onset of Injury/Illness (%)											
		<20-29		30-39		40-49		50-59		≥60			
		AMC	PMC	AMC	PMC	AMC	PMC	AMC	PMC	AMC	PMC		
Ankle, knee	11	24	18.8	14.7	9.4	13.3	0	0	3.1	4.4	3.1	1.5	1.5
Back	4	15	0	4.4	3.1	10.3	3.1	5.9	3.1	1.5	3.1	0	0
Hand, arm	7	10	6.3	0	6.3	8.8	3.1	4.4	6.3	1.5	0	0	0
Trunk, head	5	5	6.3	1.5	9.4	1.5	0	1.5	0	1.5	0	1.5	0
Teeth, face	0	8	—	4.4	—	4.4	—	0	—	1.5	0	1.5	0
Eye, eyelid	1	5	3.1	4.4	0	2.9	0	0	0	0	0	0	0
Hearing loss	4	1	0	0	0	1.5	0	0	6.3	0	6.3	0	0
Total	32	58	34.5	29.4	28.2	42.7	6.2	11.8	18.8	10.4	12.5	4.5	1.5

Note: The two Fleet operation centers of the National Ocean Service, Office of Marine Operations, are abbreviated to AMC for Atlantic basin operations and PMC for Pacific basin operations. Because of rounding, the summed totals across columns equal more than 100.

TABLE 3

Percentage Distribution of Job Categories by Occupational Injury/  
Illness in the National Ocean Service Wage Marine Work Force, 1986

Injury/Illness	Job Category (%)											
	No. of Cases		Deck		Engineer		Wiper, Oilier		Mess		Electronics	
	AMC	PMC	AMC	PMC	AMC	PMC	AMC	PMC	AMC	PMC	AMC	PMC
Ankle, knee	11	24	12.5	14.7	3.1	1.5	6.3	2.9	6.3	10.3	3.1	0
Back	4	15	3.1	7.4	0	2.9	0	1.5	3.1	2.9	6.3	1.5
Hand, arm	7	10	6.3	2.9	6.3	7.4	3.1	1.5	0	0	3.1	2.9
Trunk, head	5	5	3.1	0	0	1.5	9.4	4.4	0	0	0	0
Teeth, face <sup>2</sup>	9	8	-	5.9	-	1.5	-	1.5	-	2.9	-	0
Eye, eyelid	1	5	0	4.4	0	0	3.1	2.9	0	0	0	0
Hearing loss	1	1	0	1.5	9.4	0	3.1	0	0	0	0	0
Total	32	68	25.0	36.8	18.8	14.8*	25.0	14.7*	9.4	16.1	12.5	4.4
											9.3	13.2

Note: The two fleet operation centers of the National Ocean Service, Office of Marine Operations, are abbreviated to AMC for Atlantic basin operations and PMC for Pacific basin operations.

\*Because of rounding, the summed totals differ by 0.1.

TABLE 4

Occupational Injury/Illness Rates per 1,000 Strength by Ship  
in the National Ocean Service Wage Marine Work Force, Pacific Basin, 1986

## Rate by National Oceanic and Atmospheric Administration Ship

Injury/Illness	No. of Cases	Fair-weather	Miller	McArthur	Townsend	Oceanographer	Rainier	Dis-coverer
		Starr	Jordan	Surveyor	Cromwell			
Ankle, knee	24	170.2	58.8	161.3	19.6	38.5	76.9	21.7
Back	15	42.6	176.5	32.2	58.8	38.5	0	43.5
Hand, arm	10	63.8	0	32.2	0	0	0	43.5
Trunk, head	5	21.3	0	0	76.9	0	71.4	0
Teeth, face	8	63.8	0	0	78.4	0	0	0
Eye, eyelid	5	21.3	0	64.5	0	0	38.5	0
Hearing loss	1	0	58.8	0	0	0	0	0
Total	58	383.0	294.1	290.3	156.9	153.8	142.8	108.7
							104.2	66.7

Note: Five occupationally injured/ill employees were not included in these computations because they were not assigned to a ship.

TABLE 5  
Occupational Injury/Illness Rates per 1,000 Strength by Ship  
in the National Ocean Service Wage Marine Work Force, Atlantic Basin, 1986

Injury/Illness	No. of Cases	Researcher	Ferrel	Rate by National Oceanic and Atmospheric Administration Ship					
				Dela-	ware II	Oregon II	Heck	Alba-	Mt.
Ankle, knee	11	116.3	90.9	166.7	0	0	58.8	19.6	0
Back	4	23.2	0	0	0	125.0	58.8	19.6	0
Hand, arm	7	23.2	90.9	0	55.6	0	0	39.2	0
Trunk, head	5	23.2	0	0	0	0	0	19.6	100.0
Teeth, face	0	-	-	-	-	-	-	-	-
Eye, eyelid	1	23.2	0	0	0	0	0	0	0
Hearing loss	4	0	0	0	111.1	0	0	19.6	0
Total	32	209.3	181.8	166.7	166.7	125.0	117.6	117.6	100.0

Note: Two occupationally injured/ill employees were not included in these computations because they were not assigned to a ship.

David Starr Jordan, and hearing loss was the most prevalent on the Oregon II. Across ships, the total incidence rate per 1,000 strength was 194.3 among Pacific basin personnel and 156.1 among Atlantic wage marines.

#### Time Lost from Work

As shown in Table 6, almost 50% of all injuries resulted in no time lost from work: 43.8% and 41.2% of all injured employees in the Atlantic and Pacific basins, respectively, reported an immediate return to work after medical treatment. If these percentages were combined with those for a time loss of 1 to 7 days, the majority of cases totaled less than a week lost from work because of occupational injury. Of special note was the finding that if plotted, the percentages across the year's time period would show a two- to threefold increase from the 15- to 30-day lost time period to the 1- to 3-month interval, which included the 45-day maximum allocation allowed to remain on continuation of pay status. Other results showed that by the end of the one-year follow-up period, three individuals, all of whom had been treated for a back injury, continued to be off duty. Two other individuals had returned to work after therapy but subsequently requested and received physical therapy.

Table 7 is a presentation of the different types of time lost from work. As can be seen, 37.5% and 50.0% of injured employees in the Atlantic and Pacific basins, respectively, continued to receive their full pay--from one day to a maximum of 45 days. The comparison between basins on these proportions was nonsignificant. The mean number of days on continuation of pay status was 16.5 for Atlantic basin personnel and 15.8 among Pacific basin employees. Also shown in Table 7 are the relatively high percentages of injured employees who had taken sick, annual, and/or shore leave. The majority of these individuals requested additional time away from work in order to continue the healing process after termination of the 45-day continuation of pay period. Three individuals were off duty on disability compensation during 1986: two workers with back injuries and one with a head injury.

#### Outcome: Costs Charged Back for Medical Care

The costs for medical care presented in Table 8 are underestimates of

TABLE 6

Percentage Distribution of Time Lost for Occupational Injury/  
Illness in the National Ocean Service Wage Marine Work Force, 1986

Injury/Illness	AMC	PMC	Time Lost from Duty (%)													
			No Time Lost		1-7 Day		8-14 Day		15-30 Day		1-3* Mo		4-6 Mo		7-12 Mo	
			No.	Cases	AMC	PMC	AMC	PMC	AMC	PMC	AMC	PMC	AMC	PMC	AMC	PMC
Ankle, knee	11	24	21.9	4.4	9.4	16.1	0	4.4	0	0	3.1	8.8	0	0	1.5	0
Back	4	15	0	7.4	6.3	8.8	0	1.5	3.1	0	0	0	1.5	0	0	3.1
Hand, arm	7	10	0	8.8	6.3	2.9	6.3	1.5	3.1	0	6.3	1.5	0	0	0	0
Trunk, head	5	5	6.3	2.9	3.1	0	0	0	2.9	3.1	1.5	3.1	0	0	0	0
Teeth, face	0	8	-	10.3	-	1.5	-	0	-	0	-	0	-	0	-	0
Eye, eyelid	1	5	3.1	5.9	0	1.5	0	0	0	0	0	0	0	0	0	0
Hearing loss	4	1	12.5	1.5	0	0	0	0	0	0	0	0	0	0	0	0
Total	32	68	43.8	41.2	25.1	30.8	6.3	7.4	6.2	2.9	12.5	11.8	3.1	1.5	0	3.1
																2.9

Note: The two fleet operation centers of the National Ocean Service, Office of Marine Operations, are abbreviated to AMC for Atlantic basin operations and PMC for Pacific basin operations.

\*Eight injured employees remained on continuation of pay status for the full 45 days; one individual returned to work on the 46th day whereas the others took leave or received compensation for additional days of healing.

TABLE 7

Percentage Distribution of Time Lost from Work: Continuation of Pay, Compensation, Sick Leave, Annual Leave, and Shore Leave in the National Ocean Service Wage Marine Work Force, 1986

Injury/Illness	No. of Cases	Type of Time Loss (%)					
		AMC	PMC	No Time Lost	Continuation of Pay	Compensation	Sick Leave
Ankle, knee	11	24	21.9	4.4	3.1	27.9	0
Back	4	15	0	7.4	9.4	10.3	0
Hand, arm	7	10	0	8.8	15.6	5.9	0
Trunk, head	5	5	6.3	2.9	9.4	4.4	3.1
Teeth, face	0	8	-	10.3	-	0	-
Eye, eyelid	1	5	3.1	5.9	0	1.5	0
Hearing loss	4	1	12.5	1.5	0	0	0
Total	32	68	43.8	41.2	37.5	50.0	3.1
							2.9
							17.6*
							12.5*
							17.6*

Note: The two fleet operation centers of the National Ocean Service, Office of Marine Operations, are abbreviated to AMC for Atlantic basin operations and PMC for Pacific basin operations.

\*Because of rounding, the column totals differ from the summed totals.

TABLE 8

Frequency Distribution of Medical Costs Incurred for Occupational Injury/  
Illness in the National Ocean Service Wage Marine Work Force, 1986

Injury/Illness	No. of Cases		Amount Charged	
	AMC	PMC	AMC	PMC
Ankle, knee	11	24	\$ 500.	\$ 3,119.
Back	4	15	343.	9,589.
Hand, arm	7	10	1,571.	1,027.
Trunk, head	5	5	923.	281.
Teeth, face	0	8	-	482.
Eye, eyelid	1	5	28.	416.
Hearing loss	4	1	450.	318.
Total	32	68	\$3,815.	\$15,232.

Note: The two fleet operation centers of the National Ocean Service, Office of Marine Operations, are abbreviated to AMC for Atlantic basin operations and PMC for Pacific basin operations. Not all medical costs had been charged back at the time of data collection.

the actual amount to be charged back to the organization; not all of the invoices had been paid at the time of data collection. As shown, back injuries accounted for the highest costs among Pacific basin personnel. Injuries to the hand, arm, and finger represented the most costly treatment in the Atlantic basin; however, one of these injuries, that of a high voltage burn to the hand, represented almost 90% of the total because it required emergency and subsequent inpatient medical attention.

**Outcome: Costs Charged Back for Continuation of Pay**

Table 9 is a presentation of the continuation of pay amounts charged back to the organization, although payments for all of the cases had not been recorded at the time of this report. Differences between basins in costs for continuation of pay were noted in that vessels in the Pacific basin had the highest costs for ankle, knee, and back injuries as contrasted with higher

TABLE 9

## Frequency Distribution of Continuation of Pay Costs Incurred for Occupational Injury/Illness in the National Ocean Service Wage Marine Work Force, 1986

Injury/Illness	No. of Cases		Cases of Continuation of Pay		Amount Charged	
	AMC	PMC	AMC	PMC	AMC	PMC
Ankle, knee	11	24	1	19	\$ 206.	\$13,937.
Back	4	15	3	7	1,743.	8,220.
Hand, arm	7	10	5	4	3,980.	3,775.
Trunk, head	5	5	3	3	5,126.	3,619.
Teeth, face	0	8	-	0	-	0
Eye, eyelid	1	5	0	1	-	86.
Hearing loss	4	1	0	0	-	-
Total	32	68	12	34	\$11,055.	\$29,637.

Note: The two fleet operation centers of the National Ocean Service, Office of Marine Operations, are abbreviated to AMC for Atlantic basin operations and PMC for Pacific basin operations. Not all continuation of pay costs may have been charged back at the time of data collection.

costs for injuries to the trunk, shoulder, rib, and lung among Atlantic basin personnel. One explanation for the higher payments for ankle and knee injuries among Pacific basin employees was that these injuries tended to be more serious than those experienced on Atlantic basin vessels (e.g., an ankle fracture versus a minor sprain), thereby requiring more convalescence time. Fairly comparable amounts between basins were paid for injuries to the hand and finger.

#### Outcome: Costs Charged Back for Compensation

Included in Table 10 are the compensation costs charged back not only for the new cases in 1986 but also for those older cases that were active during the year. Back injuries and hearing loss accounted for the major reasons for receiving a compensation award for both new and old cases recorded in 1986, which totaled 83.1% of all compensation costs. Another

TABLE 10

Frequency Distribution of Costs Incurred for Compensation  
in the National Ocean Service Wage Marine Work Force, 1986

Injury/Illness	New Cases		Amount Paid		Old Cases		Amount Paid	
	AMC	PMC	AMC	PMC	AMC	PMC	AMC	PMC
Back	0	2	-	\$13,875.	2	6	\$ 45,512.	\$ 78,183.
Hearing loss	1	0	\$6,380.	-	2	2	109,796.	18,657.
Hand, arm	0	1	-	1,232.	0	1	-	1,213.
Trunk, head	0	0	-	-	0	2	-	7,757.
Ankle, knee	0	0	-	-	0	2	-	16,088.
Multiple injuries	0	0	-	-	0	2	-	40,510.
Pneumonia (died)	0	0	-	-	0	1	-	10,056.
Total	1	3	\$6,380.	\$15,107.	4	16	\$155,308.	\$172,564.

Note: The two fleet operation centers of the National Ocean Service, Office of Marine Operations, are abbreviated to AMC for Atlantic basin operations and PMC for Pacific basin operations. Not all compensation costs had been charged back at the time of data collection.

individual had been awarded compensation, but the amount paid had not been charged back to the organization at the time of data collection.

#### **Outcome: Motivation, Restoration, and Well-being**

Using information extracted from official correspondence, medical reports, letters, and notes of telephone conversations in the injured employee's record, it was possible to determine whether or not the individual was (1) motivated to return to work, (2) rehabilitated to his or her full physical potential, and (3) restored to a satisfactory level of mental well-being. Percentages of individuals in these categories are presented in Table 11. Between basins, similar (nonsignificant) percentages of employees (almost 85%) were deemed to be motivated to return to work. It should be noted that the vast majority returned to work throughout the one-year follow-up. Unmotivated individuals were those who had taken extensive leave

from work after the injury, declined a job offer or vocational rehabilitation, failed to complete a work hardening program, canceled an appointment with a physician, refused to respond to requests for a health status report, or repeatedly sought medical care from several different specialists or paramedical providers although no physical basis for their complaints was reported in the medical reports. Injuries to the back, ankle, and knee had a higher probability than other impairments of leading to delayed recovery syndrome or a reluctance to return to work.

Percentages of injured employees who were rated as not being restored to their full physical potential were highest for back, ankle, and knee injuries in the Pacific basin and hand, arm, and finger injuries among Atlantic basin personnel. Even after surgery and/or considerable therapy, six employees with back problems stated that they were unable to withstand the demands of their jobs, suffered a recurrence, or were cautioned by a physician not to return to sea duty. Other examples of restoration to less than one's full potential included cases in which the injuries or illnesses were expected to require additional sessions of physical therapy or surgery at a future time, to remain on medication for an indefinite period of time, or to need the assistance of hearing aids.

Also shown in Table 11 are percentages of injured individuals who were rated as not achieving as high a level of mental well-being as expected after treatment for their injuries or illness. Percentages were quite similar to those reported for the comparisons of restoration to full physical potential. In addition, one back injury case was being investigated as a probable fraud, which seemed to reflect the individual's less than satisfactory state of mental well-being. Letters from an attorney at law also conveyed feelings of frustration, irritation, and anger on the part of the injured employee.

#### **Outcome: Effectiveness of Surgery and Treatment**

Table 12 is a presentation of the percentage distribution of the aftereffects of surgery and treatment. None of the comparisons between basins yielded significant results. All of the surgeries were for minor procedures, primarily suturing a cut, except for two major back surgeries for a herniated disc. One of these cases was considered less than successful

TABLE 11

Percentage Distribution of Psychosocial Aftereffects of Incidents of Occupational Injury/  
Illness in the National Ocean Service Wage Marine Work Force, 1986

Injury/Illness	No. of Cases	Motivation to Return to Work				Restoration to Full Potential				State of Mental Well-being				
		Motivated		Not Motivated		Restored		Not Restored		Satisfactory		Not Satisf.		
		%	AMC	%	AMC	%	AMC	%	AMC	%	AMC	%	AMC	
Ankle, knee	11	24	31.2	27.9	3.1	7.4	31.2	29.4	3.1	5.9	31.2	29.4	3.1	5.9
Back	4	15	6.3	17.6	6.3	4.4	9.4	14.7	3.1	7.4	6.3	14.7	6.3	7.4
Hand, arm	7	10	21.9	13.2	0	1.5	15.6	11.8	6.3	2.9	18.8	11.8	3.1	2.9
Trunk, head	5	5	12.5	5.9	3.1	1.5	12.5	4.4	3.1	2.9	12.5	4.4	3.1	2.9
Teeth, face	0	8	—	10.3	—	1.5	—	8.8	—	2.9	—	7.4	—	4.4
Eye, eyelid	1	5	3.1	7.4	0	0	3.1	7.4	0	0	3.1	7.4	0	0
Hearing loss	4	1	9.4	1.5	3.1	0	0	0	12.5	1.5	0	0	12.5	1.5
Total	32	68	84.4	83.8	15.6	16.3	71.8	76.5	28.1	23.5	71.9	75.1	28.1	25.0

Note: The two fleet operation centers of the National Ocean Service, Office of Marine Operations, are abbreviated to AMC for Atlantic basin operations and PMC for Pacific basin operations. Because of rounding, the summed totals differ across columns.

TABLE 12

Percentage Distribution of Treatment Aftereffects of Occupational Injury/  
Illness Incidents in the National Ocean Service Wage Marine Work Force, 1986

Injury/Illness	Criterion											
	Effectiveness of Surgery					Effectiveness of Treatment						
	No. of Cases	Effective	Noneffective	No. Surgery	Effective	Effective	Noneffective	AMC	PMC	AMC	PMC	
Injury/Illness	AMC	PMC	AMC	PMC	AMC	PMC	AMC	AMC	PMC	AMC	PMC	
Ankle, knee	11	24	3.1	2.9	0	0	31.3	32.4	34.4	30.9	0	4.4
Back	4	15	0	1.5	0	1.5	12.5	19.1	9.4	17.6	3.1	4.4
Hand, arm	7	10	3.1	1.5	0	0	18.8	13.2	21.9	14.7	0	0
Trunk, head	5	5	0	0	0	0	15.6	7.4	15.6	5.9	0	1.5
Teeth, face	0	8	-	0	-	0	-	11.8	-	8.8	-	2.9
Eye, eyelid	1	5	0	0	0	0	3.1	7.4	3.1	7.4	0	0
Hearing loss	4	1	0	0	0	0	12.5	1.5	12.5	1.5	0	0
Total	32	68	6.2	5.9	0	1.5	93.8	92.8	96.9	86.8	3.1	13.2

Note: The two fleet operation centers of the National Ocean Service, Office of Marine Operations, are abbreviated to AMC for Atlantic basin operations and PMC for Pacific basin operations.

because the injured employee was subsequently scheduled for another anterior cervical discectomy and interbody fusion.

Relatively high percentages of cases were shown to have received effective treatment. Less than optimal treatment was most common among employees with back injuries; none of the individuals so described returned to their jobs with NOAA. Ankle and knee problems seemed to require considerable physical therapy, particularly among Pacific basin personnel. Teeth problems, such as a chipped tooth or broken molar, typically received a recommendation for subsequent tooth restoration or crown work, which in many cases had not been performed.

#### Discussion

Results of this study identified the most frequently occurring occupational injuries in the marine wage work force of the NOS, OMO, to be those affecting the back, ankle, knee, hand, wrist, and finger (68.8% among Atlantic basin personnel and 72.1% among Pacific basin employees). Falling was the single most frequent reason causing an occupational injury, followed by pushing or pulling objects, cuts and burns, and lifting. Hearing loss was the only occupationally sustained illness that resulted in a claim for compensation during 1986.

The causes of these injuries and hearing loss cases clearly point toward several recommendations that could be implemented. First, safety programs for the prevention of injuries to the back (primarily from lifting) could prove beneficial in reducing the high compensation costs for back injuries, which along with hearing loss accounted for 83.1% of the total awarded in 1986. Such a prevention program would emphasize the importance of self-responsibility and desire in achieving a healthy back (Jillson, 1988); it also should establish lifting load limits (Greenwood, 1984) and objective lifting requirements for each job (Ziporyn, 1983). Closely associated is the need to ensure that all employees maintain a high level of physical well-being and conditioning. Several employees with a back injury, for example, were described in the attending physician's medical report as being overweight and/or in poor physical condition. Another potential contributing factor to these injuries is that of age; Sprehe (1984) reports that an age

close to retirement should be a signal to investigate more thoroughly the individual's disability claim. Overall, these results suggest that physical standards and job requirements should be established for each maritime job by age interval, which might be modified further with regard to a specific ship and the climatic conditions expected during a ship's deployment. These data also would determine the extent of physical deterioration that an employee can expect as he or she ages under various levels of weight and physical fitness.

Second, given the relatively high incidence of falling on slippery decks, particularly among Pacific basin personnel, it seems prudent to review procedures for applying and maintaining nonskid materials on deck surfaces and the need for installing more handrails. Such a recommendation could potentially reduce injuries to the back, ankle, and knee. Differences in climatic conditions, such as rougher seas as well as more rain, ice, and cold in the Pacific than Atlantic basin, probably accounted for the somewhat higher, although nonsignificant, proportions of injuries observed among Pacific basin personnel. In an effort to reduce the high costs of continuation of pay awards, another suggestion is to create jobs that could be performed while an injured employee is recovering from an injury to his or her ankle or knee. Injured employees seem to fare better if they report to work every day, even while undergoing therapy (Sprehe, 1984). Also to be considered is the importance of weight reduction for overweight employees who engage in physical therapy for an ankle or knee injury. Their added weight seems to interfere in meeting the overall goal of restoration to their full potential.

Third, eyes and ears need protective gear especially among welders, solderers, and engine department personnel. The high costs in terms of human suffering and compensation for hearing loss, in particular, could be greatly reduced through adherence to proper regulations that address protective equipment.

Fourth, a program of dental hygiene might help to reduce the incidents of chipped and broken teeth; in this study, considerable crown work was prescribed because of tooth damage caused while eating.

Fifth, several occupational injuries were caused by excessive consumption of alcohol. Alcohol rehabilitation programs are readily available, and efforts should be made to encourage individuals with an alcohol abuse problem to participate in such a program. An alcohol (and drug) abuse prevention program should be incorporated into the safety training and health promotion series. In a study of medical care usage, Zook and Moore (1980) reported that 13% of patients accounted for as much hospital billing as did the other 87%. Unhealthy habits, such as excessive drinking, heavy smoking, and overeating to the point of obesity, were more often noted in medical records of the high-cost than of low-cost patients. Thus, prevention and treatment of alcohol abuse should become integral programs in any cost containment endeavor (Hoiberg, 1988). This recommendation has been incorporated in OPTICOMAP as part of the roles of the care coordinator-claims facilitator, attending case managing physician, and line supervisor.

These prevention, intervention, and rehabilitation programs should be initiated as soon as possible after the occupational illness or injury. Greenwood (1984) emphasizes the importance of a quick return to work by stating that the longer the temporary disability period, the greater the risk that the individual will not return to work. She reports that after 6 to 12 weeks, 10-15% of low back injuries become problem cases. In the present study, three of the back injury cases had become problem cases--at the end of the follow-up all three individuals had not returned to work. For those cases where a rehabilitation program (e.g., a work hardening program) had been prescribed, the individuals seemed to be suffering from delayed recovery syndrome: one did not begin the program while the other discontinued prior to completion. Perhaps these programs should have been recommended earlier in the disability period.

Results of this study determined the average expected time off for each type of injury. Back, ankle, knee, and leg strains and sprains, for example, typically require no more than seven days off the job. For all ankle fractures, recuperation tends to last at least through the full 45-day continuation of pay period, which raises the question of whether or not the healing period for such injuries can be expected to require 45 or more days.

Back strains and herniated discs clearly are injuries that are more difficult to pinpoint as far as typical durations of convalescence.

Other findings provide support for implementing such a care coordination-case facilitation process as OPTICOMAP. The importance of timeliness, especially as associated with creating and adhering to a return-to-work plan, is emphasized in each of the key player's role in the process. For those injured employees in the present study who had not returned to work at the end of follow-up, such a plan seems to be imperative and should have been implemented during the first week of convalescence. When prolonged, this period can introduce feelings of inadequacy and estrangement from the organization. To help identify individuals who might be suffering from delayed recovery syndrome, the physician might consider administering a questionnaire, such as those identified in OPTICOMAP or the CE Scale (i.e., degree of conscious exaggeration) of the Illness Behaviour Questionnaire (Clayer, Bookless-Pratz, & Ross, 1986). Examples of other solutions from OPTICOMAP include modifying the work place to accommodate the recovering employee or providing opportunities for light work. These, along with all other aspects of the process, should help to ensure the quick return of injured workers to their job or to one that can be performed under the circumstances of their limitations.

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19 ABSTRACT (Continue on reverse if necessary and identify by block number) The purpose was to identify differences in occupational illness and injury incidence (100 cases) and contributing factors between the Atlantic and Pacific basin operations of the National Ocean Service. The most frequently occurring injuries in this wage marine work force included those affecting the back, ankle, knee, wrist, and finger; hearing loss was the only occupationally sustained illness recorded in 1986. Most injuries were caused from falling, primarily on icy, wet, or oily decks. Engine department personnel in the Atlantic basin had the highest percentages of hearing loss and injuries whereas deck personnel on Pacific basin vessels had the second highest proportions. Considerable variability in incidence rates across ships was observed. The majority of injuries resulted in a time loss from work of 0 to 7 days. The highest costs were incurred for back injuries and hearing loss. No differences between basins were noted for the variables of motivation to return to work, restoration to full potential, state of mental well-being, effectiveness of surgical procedure, and effectiveness of treatment. Recommendations were made to implement various safety training, health promotion, prevention, intervention, and rehabilitation programs.			
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